

Claims

What is claimed is:

1. A method for partial puncture retransmission in an automatic repeat request system comprising:
  - a) continuously transmitting a sequence of packets;
  - b) receiving an acknowledgment (ACK) from a receiver for each packet that is properly received;
  - c) receiving a negative-acknowledgment (NAK) from the receiver for each packet that is not properly received;
  - d) selecting a packet for retransmission corresponding to each packet that is properly received in response to receiving the NAK;
  - e) dividing the packet for retransmission into a plurality of subpackets; and
  - f) puncturing packets in the sequence of packets with the subpackets,  
wherein the receiver can recover the subpackets from punctured packets in the sequence of packets to recreate the packet for retransmission.
2. The method of claim 1 wherein when puncturing is necessary, punctured packets in the sequence of packets are punctured with one of the plurality of subpackets.
3. The method of claim 1 wherein the sequence of packets is continuously transmitted without regard to receiving the ACK.
4. The method of claim 1 further comprising encoding units of data to create encoded packets, which form the packets in the sequence of packets.
5. The method of claim 4 wherein the encoded packets comprise systematic bits and non-systematic bits and the puncturing step further

comprises replacing select non-systematic bits with bits of the subpacket being punctured into the encoded packet.

6. The method of claim 5 wherein the bits of the subpacket are substantially uniformly punctured throughout the encoded packet.
7. The method of claim 1 wherein the bits of the subpacket are substantially uniformly punctured throughout the encoded packet.
8. The method of claim 1 wherein packets in the sequence of packets are transmitted to different users and the subpackets associated with the packet for retransmission to a select user are only punctured into ones of the packets to be transmitted to the select user.
9. The method of claim 1 further comprising retransmitting an entire packet corresponding to the packet for retransmission when there are more subpackets to transmit than packets to puncture.
10. The method of claim 1 wherein the dividing step further comprises sequentially creating the subpackets with incremental redundancy.
11. The method of claim 1 wherein the dividing step further comprises creating the subpackets to facilitate Chase combining.
12. A method for partial puncture retransmission in an automatic repeat request system comprising:
  - a) continuously receiving a sequence of packets;
  - b) transmitting an acknowledgment (ACK) to a transmitter for each packet that is properly received;
  - c) transmitting a negative-acknowledgment (NAK) to the transmitter for each packet that is not properly received;
  - d) identifying punctured packets in the sequence of packets, the punctured packets punctured with subpackets corresponding to a

retransmission packet, which is a packet that was not properly received during a previous transmission;

- e) extracting the subpackets from the punctured packets;
- f) combining the subpackets to recreate the retransmission packet;  
and
- g) decoding the recreated retransmission packet.

13. The method of claim 12 wherein the punctured packets in the sequence of packets are punctured with one of the plurality of subpackets.

14. The method of claim 12 wherein the packets in the sequence of packets are encoded and further comprising decoding the sequence of packets to recover corresponding units of data.

15. The method of claim 14 wherein the packets in the sequence of packets comprise systematic bits and non-systematic bits and the punctured packets have select non-systematic bits replaced with bits of the corresponding subpackets.

16. The method of claim 15 wherein the bits of the subpacket are substantially uniformly punctured throughout the punctured packet.

17. The method of claim 12 wherein the bits of the subpacket are substantially uniformly punctured throughout the punctured packet.

18. The method of claim 12 wherein the subpackets provide incrementally redundant information necessary to recreate the retransmission packet.

19. The method of claim 12 wherein the subpackets provide information necessary for Chase combining during the combining step.

20. The method of claim 12 further comprising:

2020 RELEASE UNDER E.O. 14176

- a) transmitting a retransmission ACK to the transmitter for each packet for retransmission that is properly received; and
- b) transmitting a retransmission NAK to the transmitter for each packet for retransmission that is not properly received.

21. A system for partial puncture retransmission in an automatic repeat request system comprising:

- a) transmission and reception circuitry; and
- b) processing logic associated with the transmission and reception circuitry and adapted to:
  - i) continuously transmit a sequence of packets;
  - ii) receive an acknowledgment (ACK) from a receiver for each packet that is properly received;
  - iii) receive a negative-acknowledgment (NAK) from the receiver for each packet that is not properly received;
  - iv) select a packet for retransmission corresponding to each packet that is properly received in response to receiving the NAK;
  - v) divide the packet for retransmission into a plurality of subpackets; and
  - vi) puncture packets in the sequence of packets with the subpackets,

wherein the receiver can recover the subpackets from punctured packets in the sequence of packets to recreate the packet for retransmission.

22. The system of claim 21 wherein when puncturing is necessary, punctured packets in the sequence of packets are punctured with one of the plurality of subpackets.

23. The system of claim 21 wherein the sequence of packets is continuously transmitted without regard to receiving the ACK.

24. The system of claim 21 wherein the processing logic is further adapted to encode units of data to create encoded packets, which form the packets in the sequence of packets.

25. The system of claim 24 wherein the encoded packets comprise systematic bits and non-systematic bits and the processing logic is further adapted to replace select non-systematic bits with bits of the subpacket being punctured into the encoded packet.

26. The system of claim 25 wherein the bits of the subpacket are substantially uniformly punctured throughout the encoded packet.

27. The system of claim 21 wherein bits of the subpacket are substantially uniformly punctured throughout the encoded packet.

28. The system of claim 21 wherein packets in the sequence of packets are transmitted to different users and the subpackets associated with the packet for retransmission to a select user are only punctured into ones of the packets to be transmitted to the select user.

29. The system of claim 21 wherein the processing logic is further adapted to retransmit an entire packet corresponding to the packet for retransmission when there are more subpackets to transmit than packets to puncture.

30. The system of claim 21 wherein the processing logic is further adapted to sequentially create the subpackets for a given packet for retransmission with incremental redundancy.

31. The system of claim 21 wherein the processing logic is further adapted to sequentially create the subpackets for a given packet for retransmission to facilitate Chase combining.

32. A system for partial puncture retransmission in an automatic repeat request system comprising:

- a) transmission and reception circuitry; and
- b) processing logic associated with the transmission and reception circuitry and adapted to:
  - i) continuously receive a sequence of packets;
  - ii) transmit an acknowledgment (ACK) to a transmitter for each packet that is properly received;
  - iii) transmit a negative-acknowledgment (NAK) to the transmitter for each packet that is not properly received;
  - iv) identify punctured packets in the sequence of packets, the punctured packets punctured with subpackets corresponding to a retransmission packet, which is a packet that was not properly received during a previous transmission;
  - v) extract the subpackets from the punctured packets;
  - vi) combine the subpackets to recreate the retransmission packet; and
  - vii) decode the recreated retransmission packet.

33. The system of claim 32 wherein the punctured packets in the sequence of packets are punctured with one of the plurality of subpackets.

34. The system of claim 32 wherein the packets in the sequence of packets are encoded and the processing logic is further adapted to decode the sequence of packets to recover corresponding units of data.

35. The system of claim 34 wherein the packets in the sequence of packets comprise systematic bits and non-systematic bits and the punctured packets have select non-systematic bits replaced with bits of the corresponding subpackets.

36. The system of claim 35 wherein the bits of the subpacket are substantially uniformly punctured throughout the punctured packet.

37. The system of claim 32 wherein the bits of the subpacket are substantially uniformly punctured throughout the punctured packet.
38. The system of claim 32 wherein the subpackets provide incrementally redundant information necessary to recreate the retransmission packet.
39. The system of claim 32 wherein the subpackets provide information necessary for Chase combining during the combining step.
40. The system of claim 32 wherein the processing logic is further adapted to:
  - a) transmit a retransmission ACK to the transmitter for each retransmission packet that is properly received; and
  - b) transmit a retransmission NAK to the transmitter for each retransmission packet that is not properly received.